Development of the CdSe Quantum Dot-Sensitized Solar Cells by Layer-By-Layer Method

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Abstract**:** *Quantum dot-sensitized solar cells (QDSSCs) have attracted increasing interest because of the various advantages of QD sensitizers such as high molar extinction coefficients, easily tunable bandgaps, large intrinsic dipole moments, and possible multiple carrier generation. Although large progress have been achieved, the cell efficiency of QDSSCs is still far behind either the efficiency of dye sensitized solar cells (DSSCs) or the theoretical thermodynamic efficiency of QDSSCs. Recently, a layer-by-layer (LbL) deposition technique for constructing multilayer films has received great attention because of its simplicity in procedure and wide choice of materials. A multilayer of QDs is preferred for QDSSCs over a monolayer counterpart to fully utilize the sunlight incident. Solar cells fabricated with multiple layers of QDs are advantageous because cells with wider spectral absorbance ranges can be made. On the other, the phenyl diazonium salts with functional groups are very useful chemicals because there are two reactive functional groups. One functional groups, phenyl diazonium group, could be easily made phenyl radicals, which are easily introduced on the electrode surface. Other functional groups, usually thiol group could be immobilized the QDs particle. However, there are no reports for preparation QDSSCs by LbL method using diazonium salts until now, to our knowledge.*

In this study, we synthesized the CdSe QDs by aqueous synthesis using instable selenium precursor (NaHSe) as precursor. We also performed the preparation of the QDSSCs by LbL method onto ITO electrode. The QDSSCs have three layers with CdSe QDs layers and thiol phenyl alternate layers. The synthesized CdSe QDs with 2~3 nm and sphere type were confirmed via TEM, DLS, UV, and PL. The surface characterizations of CdSe QDs-sensitized solar cells were characterized SEM, AFM, contact angle, FT-IR, and XPS analysis. The solar cell performance is performed by solar simulator.

Keywords: *quantum dot-sensitized solar cells, diazonium salts, layer-by-layer method*